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ABSTRACT

The results of the first International Association for the Evaluation of Education Achievement (IEA) survey of science subjects are summarized in this document. The purpose of this survey was to gather data from nationally represented samples of schools, teachers, and pupils from 19 countries and determine the factors accounting for variations between pupils, schools, and the various national school systems. The survey showed that the most variation between schools and pupils in terms of measured achievement and skill was attributed to factors outside the school. The rationale, aims, and Sweden's participation in a second survey are also reviewed, including the objectives and sample populations of the Swedish survey. (Author/DS)

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1 BACKGROUND: THE FIRST IEA SURVEY OF SCIENCE SUBJECTS

The first IEA[1] survey of science subjects was conducted between 1969 and 1973, data being collected in 1970 (Comber & Keeves, 1973; Husén et al., 1973). Data from nationally representative samples of schools, teachers and pupils were collected in nineteen countries, including Sweden. The purpose of the project was to describe the various school systems and if possible to determine the factors accounting for variations between pupils, schools and the various national school systems. The survey showed that most of the variation between schools and between pupils in terms of measured achievement and skills was attributable to factors outside the school. The pupils' background, including both social factors and inherited capacity, accounted for a larger amount of variation than school resources (Comber & Keeves, 1973; Noonan, 1980). A comparison of Sweden with a number of other industrialized countries revealed the following.

(1) At the ten-year age level, which in Sweden corresponds to grades 3 and 4, average Swedish achievement in science subjects was definitely superior to the corresponding achievement in other industrialized countries. At this level there was little difference between the sexes in Sweden.

(2) At the fourteen-year age level, comprising grades 7 and 8 in Sweden, the average for Swedish pupils was slightly below the average of the industrialized countries taking part in the project, and the differences between the sexes had grown considerably.

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[1] IEA = International Association for the Evaluation of Educational Achievement

(3) It was established that differences in favour ot the boys regarding the whole of science teaching were already conspicuous by the beginning of grade 4 and that they subsequently increased until the end of grade 8. These differences were smaller in biology and greater in physics, chemistry and laboratory work.

(4) The Swedish school system was found to be the most homogeneous of all the systems investigated. Variations between schools within the compulsory school system were the smallest in any of the participating countries.

(5) It was established that Swedish pupils at the ages of 10 and 14, in common with pupils of the same ages in several other industrialized countries, displayed quite negative attitudes towards school. Closer investigation of pupil attitudes towards natural science yielded several interesting findings (Husén & Mattsson, 1978). Firstly, no massive aversion to science, of the kind often presumed in the debate, was found to exist. Secondly sex differences of attitude were strikingly small, which has important implications concerning the achievement of a better balance between the sexes in recruitment for scientific and technical studies.

2 A SECOND IEA SURVEY OF SCIENCE SUBJECTS

Educational systems are changeable. The first IEA survey of science subjects took place during a period of transition between two elementary school curricula, Lgr 62 and Lgr 69. A new curriculum, Lgr 80, came into force in the autumn of 1980 and is to be fully implemented from the 1982/83 school year. The SIA reform[1)] has led to a decentralization of decision making and to changes in working methods and the organization of the working day. Since the first IEA survey was carried out,

[1)] SIA is short for "skolans inre arbete" which means "the internal organization of school activities".

a new integrated upper secondary school has been established through the amalgamation of the former gymnasium, continuation school and vocational school.

Important changes have also occurred in many other countries which took place in the first survey. There has been an increase of decentralization in many industrialized countries during the past decade. Changes have taken place in recruitment for upper secondary schooling, with increasing numbers of young persons studying for an increasing length of time. It is important to carry out evaluations at intervals of ten or fifteen years in order to obtain evidence on which to base decision making and in order to arrive at a better understanding of the teaching and learning process and the factors influencing its results. Accordingly, the IEA plans to carry out a new survey of science subjects.

The international project has three overriding aims.

(1) To elucidate the increased centralization which has occurred in many countries in recent years and to investigate its potential consequences.

(2) To elucidate the changes undergone by upper secondary school recruitment in many countries and the changes which have also occurred at elementary school level in certain countries.

(3) To describe the pupils' knowledge of science subjects and their attitudes towards science, and to compare these cognitive levels and attitudes with the findings obtained in 1970.

The following pupil populations have been defined in the international IEA project.

Population 1: all ten-year-olds in the regular school system.
Population 2: all fourteen-year-olds in the regular school system.
Population 3: all pupils in their final year of secondary school.

These populations were defined in the first IEA survey of science subjects and were selected for both practical and theoretical reasons. Pupils under the age of 10 cannot really be studied with the aid of questionnaires. Ten-year-old pupils in Sweden have not yet studied science as a separate subject, and their knowledge is more to be regarded as general knowledge acquired mostly out of school. Nearly all fourteen-year-olds in the industrialized countries taking part in the first survey were attending school, but in some countries a selection took place already at the age of 14 or 15. This made it appropriate for 14-year-olds to be included so as to guage the "end product" of school in terms of the knowledge acquired by many children. It was also appropriate to have a yardstick of the "end product" among pupils in their final year of secondary school.

3 SWEDISH PARTICIPATION IN THE INTERNATIONAL SURVEY

Sweden in now participating in the second international IEA survey of pupils' knowledge and attitudes concerning science subjects. The plan is for the Swedish survey to be very largely based on the national situation, at the same time as participation in the international survey will facilitate comparisons with other countries. The purpose of the Swedish survey is as follows.

(1) To chart events since 1970 regarding curricula and the knowledge and attitudes of pupils at different age levels.

(2) To study the effects of the introduction of the new science curricula in elementary school and upper secondary school.

(3) To evaluate the level of competence regarding basic skills in the science sector.

(4) To investigate achievement in relation to the demands made by various recipients (prospective employers, further education etc.).

(5) To investigate the pupils' attitudes towards science and science subjects.

(6) To investigate sex differences in achievement and attitudes.

(7) To investigate the connection between teaching factors and the pupils' achievement levels and attitudes.

(8) To make international comparisons of pupils' achievement and attitudes in the science sector.

It should be noted that the effects of a new curriculum are impossible to guage while the curriculum is being introduced. As regards elementary school, therefore, the survey findings will be regarded as a "closing of accounts" for Lgr 69 and a baseline for Lgr 80.

The following populations will be tested in Sweden.

Population 1a: all pupils in grade 3 of elementary school.
Population 1b: all pupils in grade 4 of elementary school.
Population 2a: all pupils in grade 7 of elementary school.
Population 2b: all pupils in grade 8 of elementary school.
Population 2c: all pupils in grade 9 of elementary school.
Population 3a: all pupils in grade 3 of upper secondary school, Natural Sciences Line and Technology Line.
Population 3b: all pupils in grade 3 of upper secondary school, Social Line, Liberal Arts Line and Economics Line.
Pupulation 3c: all pupils in grade 3 of the other three-year lines of upper secondary school and all pupils in grade 2 of all two-year lines.

The timetable for the Swedish survey is determined to a great extent on that of the international survey. Testing will take place in April-May 1983. Several interim reports are expected

to be published as the project proceeds, and the final report will be published in the second half of 1985. The Swedish umbrella project, which may come to incorporate several subsidiary projects, has been named Swedish science subjects in an international perspective: curriculum, teachers and pupils (SNILLE).

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